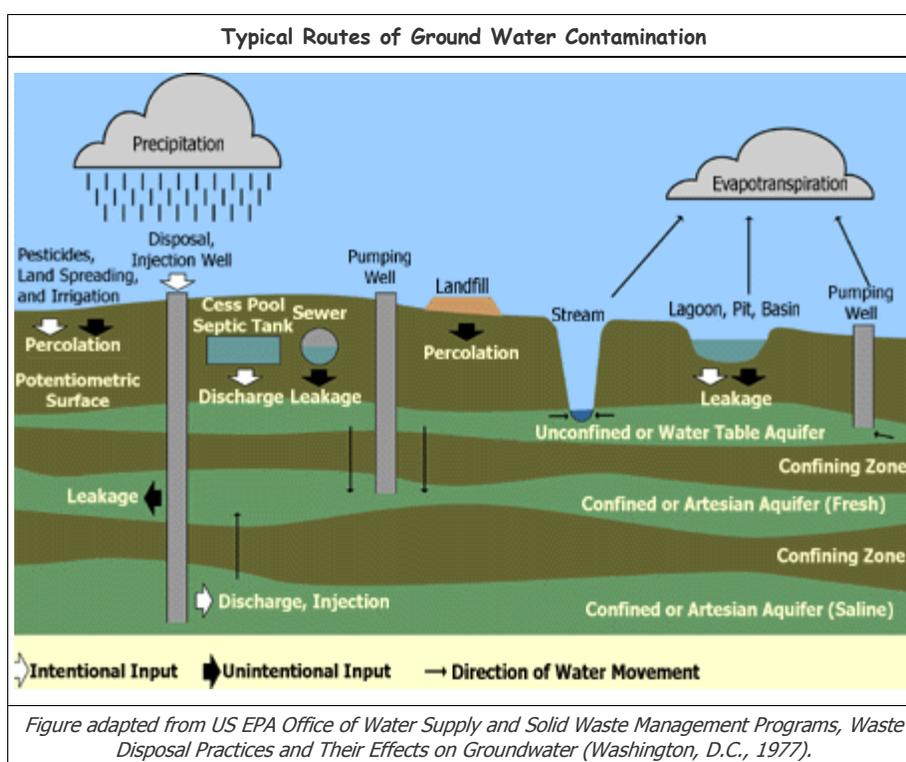


GROUND WATER QUALITY PROTECTION

PERMITTING INFORMATION DOCUMENT



UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

DIVISION OF WATER QUALITY

GROUND WATER PROTECTION SECTION

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UTAH GROUND WATER QUALITY PROTECTION

PERMITTING INFORMATION DOCUMENT

This information document is designed to give interested parties an overview of the Ground Water Quality Protection Permitting Program in the Division of Water Quality (DWQ), Utah Department of Environmental Quality. Potential applicants for a ground water discharge permit will find assistance in understanding the permitting process as well as site-specific help for formulating applications. Readers are encouraged to consult the Table of Contents to locate areas of interest.

Part I of this document provides an overview of the primary elements of a ground water discharge permit. Specific permit requirements will depend on the type of facility and its location. Part II provides an overview of the permit application process, which should begin with pre-design discussions. Part III provides an overview of the administrative procedures for obtaining a permit including permit application review, draft permit preparation, public notice and comment, and final permit issuance. Part IV describes common hydrogeologic settings in Utah and how these may affect permit requirements. Part V lists possible designs for appropriate containment control technology for various types of discharging facilities. The designs described in this section will fulfill the requirements for use of best available technology for the types of facilities and different settings, but permit applicants may propose alternative designs which meet the requirements for ground water protection.

A permit application form is provided in Appendix A to assist applicants in submitting a Ground Water Discharge Permit Application. This format is not mandatory and applicants are free to use the format they deem appropriate as long as the requirements of R317-6-6.3 of the Ground Water Quality Protection Rules are met.

The information in this document is only guidance to assist interested parties in understanding the Ground Water Discharge Permit Program. This document should not be considered to have any force of law or regulation. Please consult the Utah Administrative Rules for Ground Water Quality Protection (UAC R317-6) for specific regulatory requirements. For a copy of the rule, please go to the following internet address, visit the Ground Water website, or contact the Division of Water Quality at the address below.

Link to Ground Water Quality Protection Rules:
<http://www.rules.utah.gov/publicat/code/r317/r317-006.htm>

Link to Ground Water Protection Home Page:
<http://www.deq.utah.gov/ProgramsServices/programs/water/groundwater/index.htm>

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I. Overview of Ground Water Permits

The Utah Administrative Rules for Ground Water Quality Protection (UAC R317-6) were promulgated in August 1989 to protect existing and probable future beneficial uses of ground water quality in the State of Utah. These regulations establish a framework for requiring ground water quality discharge permits for facilities that would potentially discharge pollutants to ground water. The ground water quality discharge permit is the state's mechanism to assure that ground water quality is protected.

Who needs a permit?

Any facility or activity which causes or has the potential to cause a discharge of pollutants to ground water may be required to obtain a ground water discharge permit. This includes land application of wastes; waste storage pits, piles, landfills, and dumps; liquid waste storage facilities at large animal feeding operations; mining, milling, metallurgical and mineral extraction operations including heap leach facilities; wastewater pits, ponds, and lagoons; and process water ponds and impoundments. Some facilities and activities may qualify for "permit by rule" status and would not have to go through the formal individual permitting process. Examples of "permit by rule" sites include facilities or activities that are regulated by other agencies (such as coal mines regulated by the Division of Oil, Gas & Mining) or where the activity has a *de minimis* (negligible) impact on ground water quality. A list of facilities that qualify for permit by rule status is provided in UAC R317-6-6.2. Permit by rule facilities are still responsible for any ground water contamination they cause. The Executive Secretary of the Water Quality Board may require a permit application for a "permit by

rule" facility after a review shows that any discharge may be causing or is likely to cause the ground water quality standards to be exceeded.

Additionally, in instances where a waste water treatment structure such as a pond or lagoon is being considered, a construction permit is required. A construction permit addresses the engineering aspects of the containment technology to control wastes and wastewater, and ensures that the facility is properly designed and constructed.

What are the Working Elements of a Ground Water Discharge Permit?

Ground Water Protection Levels

Each permit establishes *ground water protection levels* that are site-specific to that facility. Protection levels are concentration limits for chemical parameters that may be associated with that particular facility. Protection levels are based on background ground water quality and ground water quality standards. Utah Ground Water Quality Standards are based on EPA drinking water maximum contaminant levels (MCLs) and health advisories, or risk-based contaminant levels or other standards established by other regulatory agencies.

The UAC R317-6 rules recognize four classes of ground water quality based on total dissolved solids content and presence of any contaminants which could impair beneficial uses of ground water. Depending on site-specific background ground water quality and ground water class, protection levels are set at a fraction of the ground water quality standard or background concentrations of constituents in the site's ground water. For example, in the case of high quality Class IA Pristine or Class II Drinking Water Quality ground water, protection levels are set at the greater of

0.25 times the standard, or 1.25 times the background concentration, or the background plus two standard deviations. The intent of the permit is to insure that concentrations of constituents in the ground water do not exceed the protection levels. An exceedance of protection levels is an early warning that the facility may cause more serious problems unless actions are taken to correct the source of the problem.

Containment Control Technology

To assure that the facility does not contaminate the ground water, appropriate control measures are required that will reduce or eliminate any process water, wastewater, or leachate from leaving the facility and discharging to ground water. The UAC R317-6 rules require that all facilities use the *best available technology* (BAT) to minimize any discharge of pollutants. BAT is defined as “the application of design, equipment, work practice, operation standard or combination thereof to effect the maximum reduction of a pollutant achievable by available processes and methods taking into account energy, public health, environmental and economic impacts and other costs”. Examples of such control technology would include:

- Low permeability clay liners
- Geomembranes such as high density and low density polyethylene (HDPE and LDPE) liners, some with leak detection and removal systems
- Capping solid waste to minimize leachate formation
- Waste pre-treatment (e.g. tailings neutralization)
- Best management practices to prevent ground water contamination

The permit applicant must propose appropriate control technology which will prevent protection levels from being exceeded. The control technology selected for any given setting should be based on several factors including:

- Hydrogeologic Setting – depth to ground water, vadose zone lithology, background ground water quality, aquifer type (unconfined water table, confined, bedrock fracture flow, karstic limestone, volcanic lava flows)
- Nature of Potential Discharge – contaminant mobility and toxicity or concentration of contaminants in the discharge to ground water as compared to protection levels that will be contained in the ground water discharge permit.
- Methods for monitoring performance of the control technology.

More stringent control technology would be required for a facility that handles highly mobile contaminants or toxic wastes, or is located at a hydrogeologically sensitive site, or where complete containment is necessary because ground water monitoring is not feasible.

If a permit applicant proposes that dilution and attenuation of contaminants in a subsurface discharge will prevent protection levels from being exceeded, the proposal should be supported by a thorough study of ground water conditions at the site. Subsurface conditions must be well known to allow meaningful contaminant fate and transport modeling and prediction of contaminant concentrations for a period at least as long as the expected life of the facility.

Compliance Monitoring

The performance of each control technology must be evaluated with a compliance monitoring system. This system must demonstrate on a continuing basis that protection levels are being met at the facility and/or BAT is being maintained.

Two basic types of compliance monitoring are used to satisfy permit requirements. A permit applicant may directly monitor the ground water quality under the site by installing monitor wells and analyzing ground water samples on a regular frequency for compliance with ground water protection levels. Alternatively, or in addition to monitoring wells, a leak detection system built into the facility's containment control technology may be used to demonstrate that contaminants are not being released, or are being released in small quantities which would have *de minimis* impact on ground water quality.

The type of compliance monitoring system chosen for a facility depends on the site's hydrogeologic setting, the nature of the discharge or potential discharge, and the type of containment control technology employed. For example, a facility that is located in an area with very deep ground water should probably not propose a well monitoring system due to costs associated with deep wells. Such a facility may find that containment control technology which incorporates an engineered compliance monitoring system, such as a leak detection system, is an economical alternative to ground water monitoring. Careful thought and planning should go into the type of containment control technology and monitoring mechanism that is chosen for a facility that will need a ground water discharge permit. In general, costs for appropriate containment control technology are significantly less than expenditures for

remediation of ground water contamination resulting from inadequate containment.

Permit applicants who choose monitoring wells will typically need data from at least eight ground water monitoring events spaced over a year to establish background water quality and seasonal variability. In a typical case this accelerated sampling program is done on a monthly basis. Consideration may be given to issue the permit before all the background monitoring data are collected. Depending on ground water flow and travel time, compliance monitoring frequency is usually reduced to quarterly or semi-annually after one year of accelerated monitoring.

Permit Fees

The Utah Legislature has required the Division of Water Quality to collect a fee for permits issued to offset the cost of review. The schedule of fees is set annually and is available from the Division of Water Quality.

The remainder of this document will provide more specific information and guidance to help explain the ground water discharge permit process including:

- An overview of the Ground Water Permit Application Review Process.
- A synopsis of what information is required for a ground water discharge permit.
- An overview of the typical hydrogeologic settings in Utah.
- An overview of the types of control technologies that can be used for various types of facilities and hydrogeologic setting found in Utah.

Permit applicants should be familiar with the hydrogeologic characteristics of their site which may influence permit conditions such as containment control technology and/or ground water monitoring. Requirements for appropriate containment control technology may differ depending on the hydrogeologic setting. Any costs that would be associated with meeting permit requirements should be considered at the earliest possible stage of facility planning. A complete application which fulfills the requirements of the regulations will greatly expedite the permit approval process.

II. Overview of Ground Water Permit Application Requirements

Pre-Design Discussions

Because of the variety of types of facilities which are permitted and their hydrogeologic settings, the permit requirements and level of detail needed for the permit application are tailored to each individual case. Potential permit applicants are strongly urged to request a pre-design meeting with the Ground Water Protection staff of the Division of Water Quality at the earliest possible stages of planning, to determine permitting requirements and possible design options. Questions are encouraged from potential applicants prior to preparing a ground water discharge permit application to clarify and hopefully improve the design of background ground water quality characterization, containment control technologies and compliance monitoring systems.

Application Requirements

The attached application form (Appendix A) for a ground water discharge permit is provided to assist those who desire to use it. This format is not mandatory but it is

provided for assistance only. Applications will normally include written descriptions, plans, drawings, maps and cross sections to meet the requirements spelled out in the ground water regulations.

Application requirements for a ground water discharge permit are listed in 317-6-6.3 of the Administrative Rules for Ground Water Quality Protection (UAC R317-6). The following discussion refers to requirements listed in subsections A through O of the regulations.

Applicant and Site Location Information (R317-6-6.3 A, B, C)

This portion of the application provides basic information about the permit applicant and facility, including the facility type and location.

Site Characterization and Description (R317-6-6.3 D, E, H, K, M)

This section of the application includes a characterization of the site geology, hydrogeology, soils, surface hydrology including flooding potential, background ground water quality, agricultural description, and a plat map showing wells, water bodies, and water usage within a one mile radius of the proposed site.

Waste Characterization (R317-6-6.3 F)

The chemical, physical, radiological, and toxicological characteristics of any potential effluent or leachate that has the potential to discharge to ground water must be identified for this portion of the application. This will include the average and maximum expected concentrations of any contaminants as well as the volume of leachate or effluent expected. If the waste stream will be from a process which has not started yet, the permit applicant should supply the best estimate of the waste stream characteristics using process knowledge and analog facilities.

Control Technology (R317-6-6.3 G, J)

The method that will be used to control discharges to ground water to assure that contaminants will not migrate into or adversely affect ground water quality must be described in this section. Typically this will include engineering plans and specifications of the liner or cover system technology or appropriate best management practices for the particular permit.

Compliance Monitoring (R317-6-6.3 I, L)

The application must include the mechanisms that will be used to show that the control technology used is functioning properly to protect ground water quality. This typically will include either a compliance ground water monitoring well network or a compliance monitoring system built into the control technology, or occasionally elements of both. The characteristics of the facility waste stream and site hydrogeology will dictate which approach is most appropriate and technologically feasible. A ground water compliance monitoring program will include specifics for well location, depth to ground water, well construction specifications, screen interval, compliance parameters to be sampled, monitoring frequency (e.g. monthly, quarterly, semi-annually), quality assurance and quality control program, and statistical methods to evaluate data for compliance. For source containment control monitoring, construction plans for the monitoring technology must be included in the application. The monitoring system must enable an ongoing performance evaluation of the control technology, such as a regular monitoring and reporting schedule for a leak detection system sump.

Inspection, Contingency, Corrective Action, and Closure Plans (R317-6-6.3 N, O, P, S)

This section of the application describes how the facility will be inspected to

determine that the control technology is not damaged or malfunctioning. Should problems arise, a contingency plan to correct malfunctions (already compiled in the application) can be implemented. A corrective action plan may be necessary to remedy problems that occurred at existing facilities prior to permit issuance. Lastly, the plans for final closure for the facility to assure that any long term potential for ground water contamination from the closed facility must be included. Typically this involves a decommissioning plan or a permanent capping plan along with a post closure monitoring commitment. Permit applicants should consider ways of closing a facility which will eliminate any possibility of future ground water contamination and thereby eliminate the need for long-term monitoring.

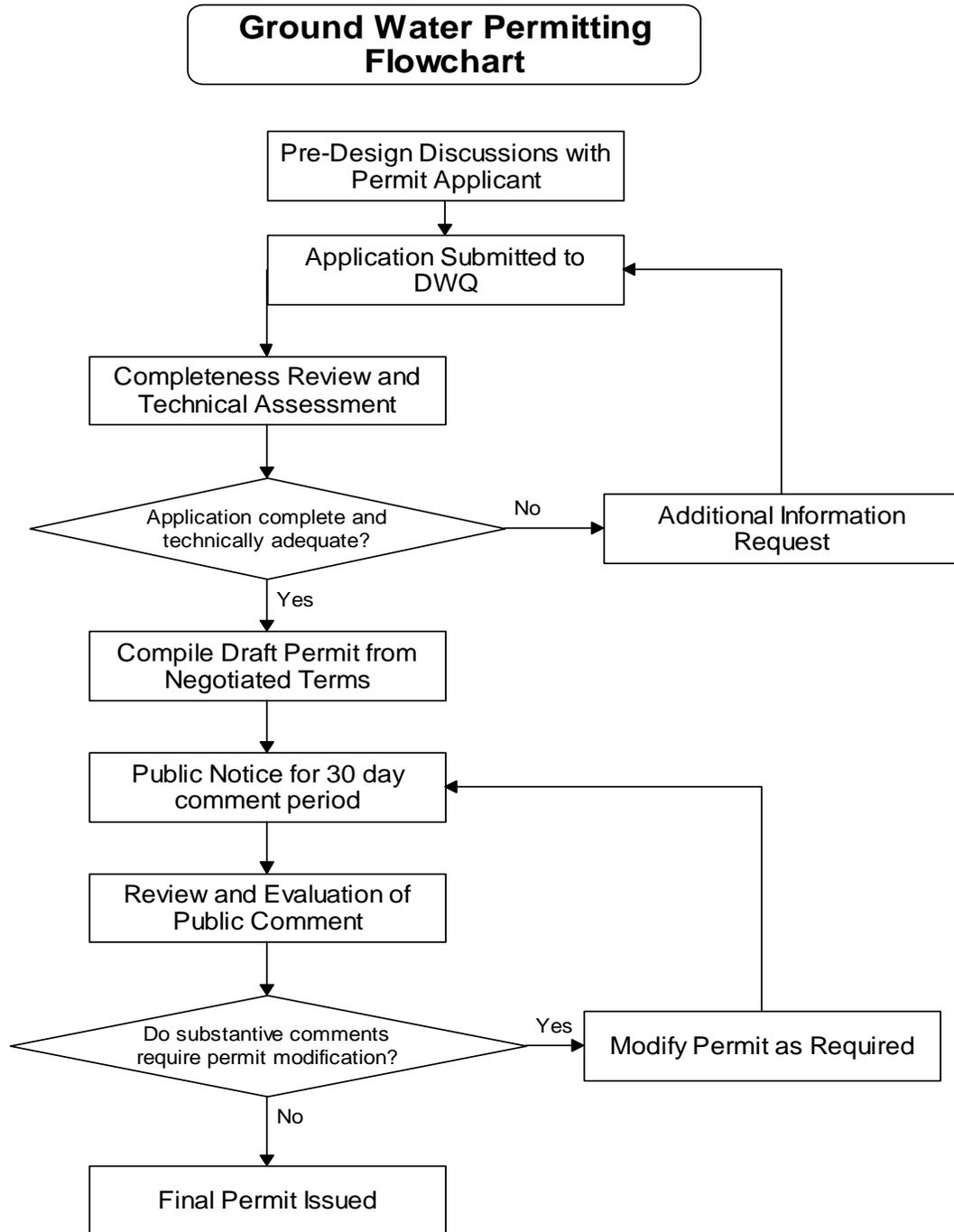
III. Ground Water Permit Application Review Process

Ground Water Discharge Permit Applications are reviewed by the Division of Water Quality staff to determine if the application meets the requirements of the Ground Water Quality Protection Regulations (R317-6-6). The process is summarized in flowchart form in Figure 1.

Review for Completeness and Technical Adequacy

The application will be reviewed by the ground water protection staff to determine if all applicable application requirements of R317-6-6.3 have been addressed (see the overview of ground water permit application requirements in this package). The proposed containment technology and compliance monitoring will be assessed to determine if they are technically feasible given the hydrogeologic setting and the nature of the facility waste stream.

Figure 1. Ground Water Permitting Process.



Draft Permit

Assuming there are no deficiencies outstanding after the permit application review, a draft permit will be prepared by the ground water protection staff. The draft permit will include the terms and conditions under which the facility will be operated. One of the most significant conditions is the establishment of ground water protection levels for the permit. The protection levels are established based on the background ground water quality in the vicinity of the facility. This includes concentrations of total dissolved solids and any chemical parameters listed in Table 1 of R317-6-2.1 that are present in the waste stream, especially mobile leakage indicators. Before protection levels can be determined, the site-specific ground water class must be defined based on background ground water quality data. Protection levels are then established in accordance with the requirements of R317-6-6.4 of the Ground Water Quality Protection Rules. Although interim protection levels can be allowed for permit issuance based on a few samples, at least eight samples collected over a one-year period are required to obtain more statistically valid protection levels. When this accelerated water quality monitoring program has been completed, the permit can be re-opened to revise ground water protection levels.

A Compliance Schedule can be included in the permit for items that the applicant must address within a certain time frame. Examples of compliance schedule items include the installation of additional monitoring wells, the completion of an accelerated monitoring program to establish protection levels, or the preparation and submission of a best available technology (BAT) performance monitoring plan for engineered containment controls.

This stage of the permit process will involve communication between the assigned staff permit manager and the applicant so that both parties are amenable to the terms and conditions of the draft permit. The applicant is given opportunity to review the draft permit and provide comment to express any concerns prior to the draft permit being public noticed.

Public Notice and 30-day Comment Period

The Ground Water Quality Protection Rules specifically require that a notice of intent to approve is published in a newspaper in the affected area for every proposed permit. This notice opens a 30-day public comment period in which interested parties or individuals are invited to provide comment to the Executive Secretary of the Water Quality Board. At the close of the 30-day period, each comment received is evaluated and considered. Using the regulations as a guide, changes to the draft permit can be made to address substantive comments. If any substantial changes are made to the draft permit in response to public comments, the permit will be subjected to another 30-day public comment period. If changes made are not substantive, the permit can be issued without additional public notice and comment.

Final Permit Issuance

Following the public comment period, if all requirements of the regulations have been met, the permit is signed by the Executive Secretary of the Utah Water Quality Board and issued to the applicant. Permits are generally issued for a five-year term with the opportunity to renew assuming no significant problems have arisen. Typically, permits contain a "reopener" provision that allows the permit to be modified if necessary.

IV. Common Hydrogeologic Settings in Utah

Ground Water Vulnerability

The following discussions rank the various hydrogeologic settings for their vulnerability to ground water contamination in relation to appropriate best available containment technology and monitoring. These rankings are only intended to be a general guide for applying appropriate control technology for a particular region. Actual site conditions may be more or less susceptible to ground water pollution, and may allow for permit conditions which are more or less stringent than those listed for the site's general setting. Settings defined as "high" vulnerability are areas where the geologic conditions would allow pollutants to move directly into usable ground water. "Moderate" vulnerability denotes areas where the geologic structure would probably retain a release of contaminants long enough to allow a cleanup before the contaminants moved into usable ground water. "Low" vulnerability applies to areas which generally have poor quality ground water and soils with low permeability or near-surface aquitards which would tend to retain contaminants, and there is little chance that contaminants would move into usable ground water. Figure 2 shows the distribution of some of the more widespread hydrogeologic environments.

Great Basin Alluvial Valleys

East-west extension of the earth's crust between central Utah and the Sierra Nevada Mountains of California has formed a region of alternating steep, narrow mountain ranges and alluvial basins. The basins are typically filled with many thousands of feet of unconsolidated alluvial deposits which hold the most productive and heavily used

aquifers in Utah. During the Pleistocene "ice age" period when the climate was cooler and wetter than the present, lower areas of western Utah were covered by Lake Bonneville. This ancient freshwater lake reached its maximum elevation of about 5100 feet approximately 15,000 years ago. In many of these valleys, clay and other fine-grained materials were deposited in deep lake waters in the lower valley areas, while coarser sand and gravel were deposited along the higher valley edges where they were reworked by waves and streams flowing into the lake. Pre-Bonneville deposits now covered by the clay were composed of coarse-grained sands and gravels that now are artesian aquifers which are confined by the clay. The presence of the clay confining layers produces a distinct hydrogeologic setting which is typical of the most heavily populated and developed areas of Utah. These aquifers are recharged by precipitation and streamflow on the coarse deposits along the high valley edges, and by ground water flow from the surrounding mountains. Because these recharge zones consist of coarse deposits which are continuous with and higher than the pre-Bonneville sands and gravels, ground water under the confining clay layers is under artesian pressure. Figure 3 is a schematic representation of this hydrogeologic system.

The upward hydraulic gradient of confined aquifers protects them from contamination sources located above the confining units, even though the confining units are not laterally continuous and have some leakage through them. Confined aquifers are highly vulnerable to contamination introduced into their recharge zones with unconfined water table conditions. Overproduction of water from confined aquifers may cause a reversal of the upward gradient and cause poor-quality shallow ground water to infiltrate downward into formerly confined aquifers.

Figure 2: Primary Utah aquifer systems.

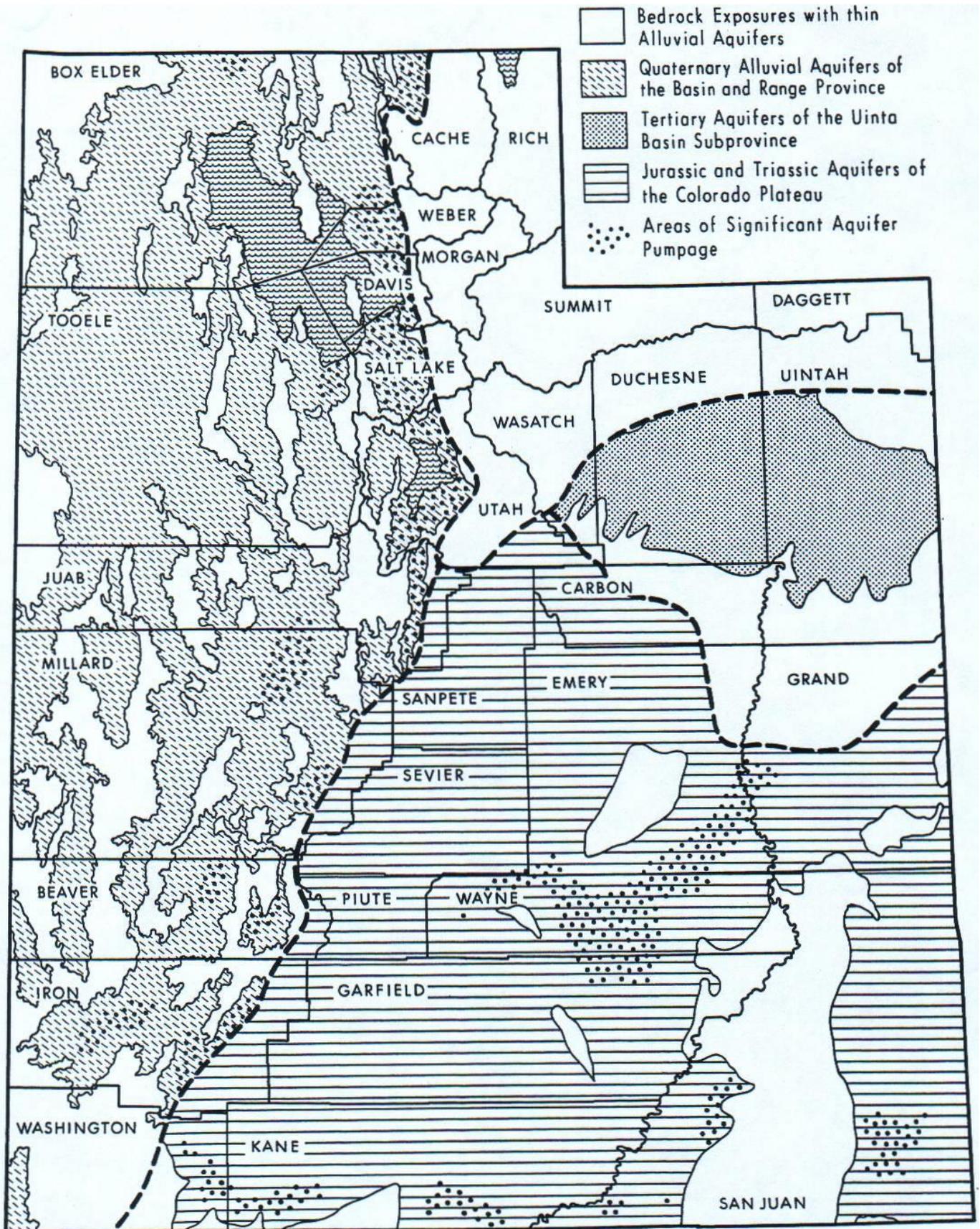
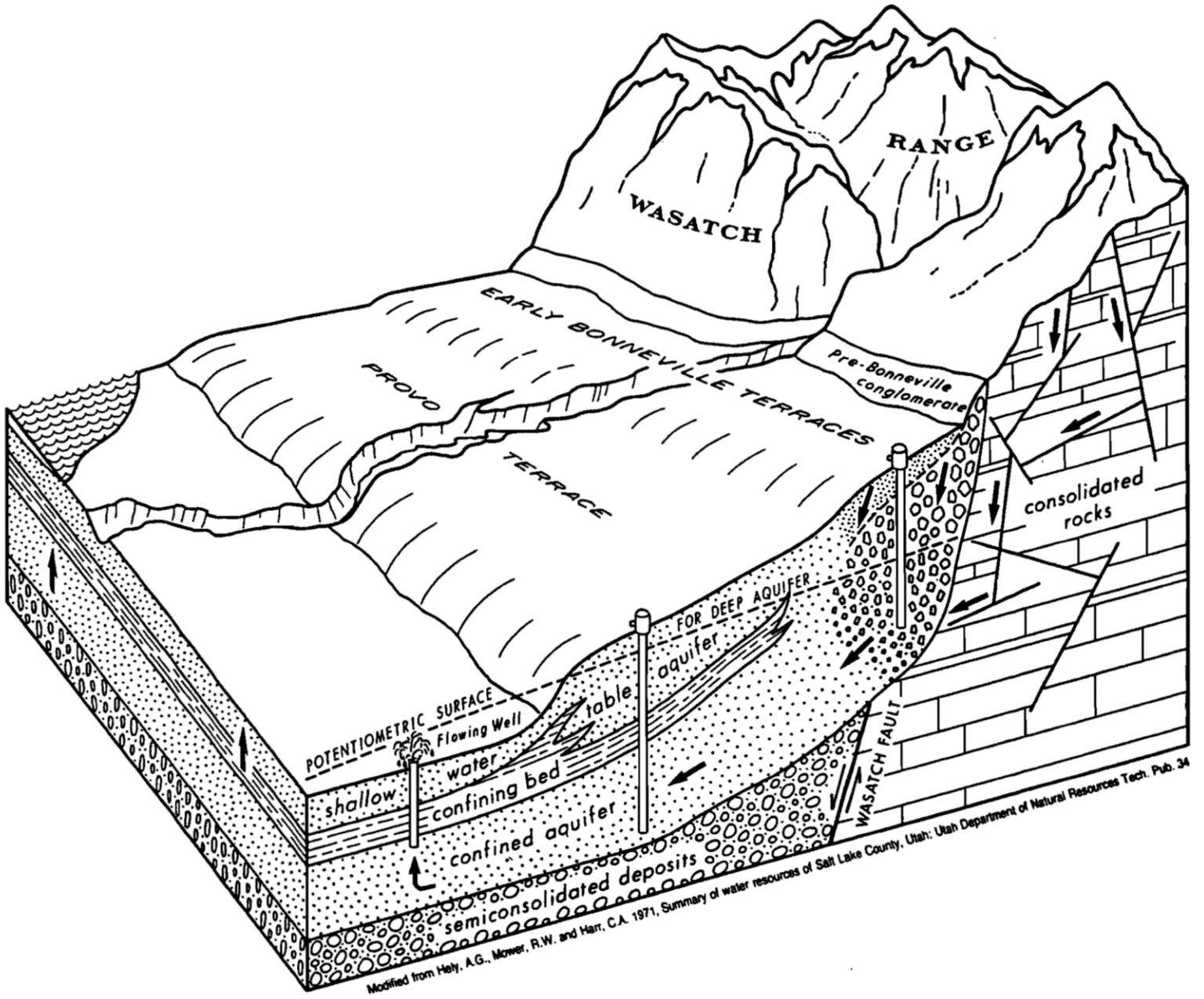


Figure 3: Typical alluvial aquifer system.



In northwestern Utah, the aquifers discharge in the salt flat areas surrounding the Great Salt Lake, a regional discharge area.

Valleys which stood higher than the level of Lake Bonneville may lack continuous confining layers. In a general sense, these valleys have coarser-grained deposits along their margins and finer-grained sediments in their central areas. Coarse deposits may extend into the central areas along ancient and modern stream channels. Ground water in these valleys may be under unconfined conditions.

Considerations for Ground Water Permitting

1. Recharge Zones (high vulnerability)

Recharge zones are highly vulnerable to contamination and are generally areas of deep ground water. Ground water monitoring would be difficult and costly and would not provide a warning of a release until significant contamination had already occurred. To avoid risks of ground water contamination and high costs of monitoring, permitted facilities in recharge zones may wish to employ designs which prevent any release of contaminants. An example of such design would be two synthetic liners separated by a geogrid, with the geogrid space between the liners designed to drain to a collection sump which can be monitored for head, volume, and water quality analysis. Vadose zone monitoring may be appropriate in some cases. Less protective containment technology may be allowed if water discharged by a facility will not impact ground water quality. Because they are mostly coarse-grained, soils in these areas have low capacity to retain contaminants and impede infiltration to ground water. Areas where streams flow out of the mountains across coarse-grained alluvium along the mountain front are major recharge areas for the adjacent alluvial valley aquifer.

Therefore, land application or construction of facilities that discharge contaminants to the subsurface is not recommended.

2. Lower Areas in Valleys with Lake Bonneville Confining Layers (moderate vulnerability)

Shallow ground water in lower valley areas is generally of poorer quality than deeper ground water in pre-Bonneville deposits. The shallow ground water will be protected for its limited uses and to prevent contamination of deeper aquifers. Facilities should be designed in such a way that any releases of contaminants do not cause an exceedance of protection levels. Ground water monitoring well networks can usually be designed in these areas which will provide timely notice of exceedance of protection levels. A greater risk of contamination may exist if the facility is in a well-head protection zone, if potential pathways exist which may introduce contaminants into deep aquifers (such as abandoned wells), if there is a possibility the hydraulic gradient may be reversed, or if the facility handles dense non-aqueous phase liquids. In these cases the permittee may wish to evaluate more stringent containment technology.

3. Salt Flats (low vulnerability)

Salt flats are generally areas of fine-grained soils and poor-quality ground water which is moving upward from deeper aquifers. Ground water in these areas will be protected for beneficial uses such as salt extraction. Discharge of contaminants which are not naturally present in the ground water, such as synthetic compounds or radionuclides will require best available technology to prevent their release. Design of monitoring well networks should take any upward hydraulic flow into consideration and should sample ground water which will be first affected by discharges from the

facility. Construction of impoundments with flexible membrane liners may not be feasible due to accumulation of rising ground water under the liners and resulting structural disturbance.

4. Valleys without Confining Layers (moderate to high vulnerability)

In valleys lacking lake clay confining layers, the entire valley may act as a recharge zone for unconfined aquifers underlying the valley surface. Design considerations would be similar to those in recharge zones, unless the site has poor quality ground water, continuous confining layers, or the ground water is shallow and moving upward under artesian pressure. A monitor well network can be designed to provide timely warning of any exceedance of protection levels. In these latter cases, less stringent containment technology may be employed if a meaningful compliance monitoring plan can be designed.

Mountains

Mountainous areas in Utah are sources of surface water and a recharge zone for aquifers which are in adjacent lowland valleys. Ground water in mountains is usually of very good quality and may be closely connected with surface waters. For these reasons, ground water in mountainous areas is protected to the greatest extent possible. Ground water flow systems in the mountains follow the geologic structure and are usually highly complex. The water table in these areas can also be very deep. These factors can make it very difficult and expensive to design a satisfactory ground water monitoring system. Permit applicants in these areas are encouraged to use best available containment technology to prevent and discharge of pollutants. Some facilities which discharge must be located in mountainous areas, particularly those related

to mining operations. In these cases, a major effort may be required to monitor ground water and demonstrate compliance with the regulations.

Most sedimentary, intrusive igneous and metamorphic bedrock in Utah's mountains has relatively low primary porosity. Ground water flow is primarily along fractures. A satisfactory ground water monitoring plan must monitor the potential pathways that discharged fluids are likely to follow. These may be very difficult to predict and model, particularly where fracture orientation, width and density are not known.

Extensive, thick limestone formations comprise many mountain masses in Utah, including the Bear River Range, the southern Wasatch Mountains and many of the Great Basin mountain ranges. Fracture flow systems and deep ground water in these areas are further complicated by the presence of caves and other solution openings in the rock. These may allow for very rapid movement of contaminants to the ground water, with little opportunity for retention on soil or rock surfaces. Fractured limestone areas along mountain front faults are especially vulnerable for introducing contaminants into adjacent alluvial aquifers in the valleys.

Exposures of volcanic rocks are scattered throughout the western half of Utah and are particularly abundant in the south-central and southwestern parts of the state. Geologically young volcanic rocks typically are highly permeable, with ground water flow through fragmental deposits, gravel beds between lava flows, lava tubes and vesicles, and cooling fractures within lava flows and welded tuff deposits. Geologically older volcanic rocks may have lower permeability than younger deposits.

Considerations for Ground Water Permitting

1. General (high vulnerability)

To avoid risks of ground water contamination and minimize costs for compliance monitoring, permit applicants should consider designing their facilities to prevent any discharge of contaminants to the subsurface and to allow source monitoring. In planning for construction in these areas, permit applicants should consider the costs of monitoring and potential liabilities associated with discharging designs against the costs for complete containment technology. If ground water monitoring is chosen, the monitoring well network must provide timely warning of a release of contaminants. Design of such a system will probably require extensive knowledge of geologic structure and ground water flow at the sight.

2. Fractured Bedrock (high vulnerability)

If ground water monitoring is chosen, knowledge of the fracture flow system must be sufficient to determine the location of ground water which would be first influenced by discharges from the facility. Multiple pathways are possible in fracture-flow systems, particularly for facilities covering a large area, and each may require coverage from one or more wells. Lacking detailed knowledge of geologic structure in the subsurface, suitability of a particular well location may not be known until after the well is drilled. In areas with deep ground water, drilling costs may become very high.

3. Limestone Bedrock (high vulnerability)

Design of ground water monitoring systems should evaluate the effects of solution channels on ground water flow, and monitor the first ground water to be affected by discharges from the facility. Facilities should not be located near obvious

sinkholes. Land application of wastes should only be done if the permit applicant can demonstrate that it will not degrade ground water quality.

4. Volcanic Bedrock (high vulnerability)

Design of ground water monitoring systems should take into account the distribution of zones of greater and lesser permeability in predicting the pathway of pollutants discharged by the facility. Land application of wastes should avoid areas of coarse and highly permeable soils. Discharging designs may not be permissible in areas which may allow pollutants to affect water quality in wells and springs.

Colorado Plateau

The Colorado Plateau is a region of southern and eastern Utah which consists of flat-lying to gently dipping sedimentary rocks which are deeply eroded. A network of deep canyons provides drainage to this region, and alluvial deposits are mostly thin and supply little water. Sedimentary rocks in southeastern Utah are mostly of Mesozoic and Paleozoic age; a bowl-shaped depositional basin in northeastern Utah, the Uinta Basin, has accumulated many thousands of feet of Tertiary age sedimentary rocks. Hydrogeologic properties of sites in this region are greatly affected by which sedimentary formation is exposed on the surface. The most important aquifers in this region are contained in consolidated sedimentary rocks.

Among the Mesozoic sedimentary rocks of the Plateau are several massive wind-deposited sandstone units, the most important of which is the Navajo Sandstone. These units form productive aquifers where the sandstone has fractures which enhance the primary porosity. Because the Navajo and other massive sandstone units are

usually overlain by shaly formations, recharge to the aquifer is mainly from precipitation on and streamflow over the sandstone outcrop. Areas where windblown sand or alluvial deposits lie on top of the sandstones form particularly important recharge zones because precipitation is held in the deposits long enough to infiltrate into the sandstone. Ground water quality in the sandstone aquifers varies greatly.

Many other sedimentary rock formations of the Plateau consist of interbedded sandstone and shale, occasionally with other lithologies such as limestone and gypsum. Examples of this type of formation include the Mesaverde Group and related rocks of Cretaceous age and the Duchesne River and Uinta Formations of Tertiary age. Sandstone units within these formations may locally contain aquifers where permeability is enhanced by fracturing. Because of the interbedded shales, perched aquifers are common in these formations. Some formation contain interbedded evaporate minerals, which can leach into ground water and affect water quality. In some instances aquifers are contained in beds which have been leached of evaporate minerals.

Several formations consist mostly of shale and are thick enough to be significantly isolated from usable aquifers. The most important such formation is the Cretaceous Mancos Shale, but several other shaly formations have similar characteristics. Ground water circulation in the shaly units is sluggish and water quality is usually poor because of dissolution of salts contained in the rock. Because of these characteristics, facilities built on shaly units may not require designs as stringent as those needed in more sensitive settings.

The La Sal, Henry, and Abajo Mountains are comprised of shallow intrusive igneous

rocks which have domed the surrounding sedimentary rocks. This structure is referred to as a laccolith. Both the igneous rocks and the surrounding sedimentary rocks are highly fractured. These fractured areas may form important recharge zones for aquifers in the underlying sedimentary rocks. In some cases these aquifers are of regional extent and may discharge very far from the recharge zones.

During the Pleistocene ice ages, glacial meltwater from the Uinta Mountains deposited a blanket of coarse-grained "outwash" deposits in the northern Uinta Basin. These deposits contain shallow, productive unconfined aquifers. Hydraulic conductivities and ground water velocities in these coarse-grained deposits can be high, and water quality is usually good. Because of the coarse-grained texture, shallow depth and lack of confining layers, these aquifers can be highly vulnerable to contamination.

Considerations for Ground Water Permitting

1. General

Because of the drainage provided by the deeply-incised canyons of the Colorado Plateau, many sites in this region will have a deep water table. Ground water monitoring under these conditions may be very difficult and expensive. Permit applicants at such sites should consider other methods of compliance monitoring, such as containment technology or vadose zone monitoring.

2. Massive Sandstone Formations (high vulnerability)

Permit applicants should design facilities in recharge zones for sandstone aquifers to prevent any release of contaminants whenever possible. If ground water monitoring is chosen, wells should be located to monitor the first ground water which would be affected by discharges from

the facility, taking into account the fracture-flow system. In the most important recharge zones, i.e. sand dunes overlying the sandstone outcrop, the fracture pattern in the underlying sandstone is not exposed at the surface and it may be difficult if not impossible to locate monitor wells correctly.

3. *Interbedded Sandstone/Shale*

Formations (moderate vulnerability)

Ground water monitoring should be done in the same uppermost aquifer that underlies the facility, even if it is perched. An evaluation of fracturing may be necessary in sandstone aquifers to insure correct placement of monitor wells. Individual sandstone beds may have unusual geometry and may pinch out rapidly in any direction. Prediction of flow paths and monitor well placement may be difficult where several sandstone and shale beds lie between the point of discharge and the water table.

4. *Thick Shale Formations*

(low vulnerability)

Because of sluggish ground water flow, monitor wells should be located as close as practicable to the point of discharge as possible. Consolidated shale formations may have a fracture-flow system, particularly in the subsurface. Facilities should not introduce contaminants which are not naturally present in the site's ground water. Facilities should not cause an increased discharge of salts to surface water.

5. *Laccolithic Mountains*

(high vulnerability)

Design requirements would be similar to aquifer recharge zones and mountainous areas.

6. *Uinta Basin Glacial Outwash*

(high vulnerability)

Placement of monitor wells should take into account the effects that coarse aquifer

materials and high ground water velocities would have on dispersion of contaminants. Monitor well installation may be difficult in areas with boulders or cobbles in the subsurface. Land application of wastes is not recommended in these areas.

Alluvial Stream Valleys

Active streams in mountain and plateau areas are often flanked by narrow belts of alluvium which are significantly more permeable than the surrounding bedrock. Aquifers in these alluvial deposits are hydrologically connected with the stream, and contaminants released into the alluvium may move rapidly into surface water. Because the alluvium consists of channel and flood plain deposits, hydraulic conductivity may vary greatly over a short distance. Ground water in the alluvium may be recharged from both the stream and ground water flow from the bedrock. These sources may have differing water quality.

Considerations for Ground Water Permitting (high vulnerability)

Ground water protection levels may be affected by surface water quality in standards for the stream. In particular, parameters which are not usually a concern for ground water, such as biochemical oxygen demand or fecal coliforms, may need to be addressed in the monitoring program. Placement of ground water monitoring wells should take into account preferential flow paths which would result from varying hydraulic conductivity in the alluvial deposits, seasonal changes in ground water flow, and inflow of ground water from the bedrock.

V. Possible Containment Control Technologies for Permitted Facilities

The following suggestions are based on current experience. Different approaches and innovative technology will be given full consideration, provided they meet the goals contained in the Ground Water Quality Protection Rules.

Industrial Wastewater and Process Water Ponds

Impoundments designed to hold process water or dispose of wastewater by evaporation are required to obtain both a ground water discharge permit and a construction permit from the Division of Water Quality. Requirements for containment control technology vary depending on the nature of the fluids stored in the ponds and the hydrogeologic setting. A construction quality assurance/quality control plan must be used to insure the facilities are constructed to perform as designed.

In situations where some release of the fluids stored in the pond would not cause ground water protection limits to be exceeded, a clay liner with a permeability no greater than 1×10^{-7} cm/sec or less which allows a seepage rate of 1/8 inch per acre per day may satisfy permit conditions. In these cases the permit applicant must demonstrate that wastewater seepage through the clay liner will not cause an exceedance of ground water protection levels. Ground water monitoring is usually needed under this option to demonstrate that ground water degradation is not occurring. Permit applications must have contingency and closure plans which commit to remediate ground water contamination caused by the facility and prevent contamination after closure.

In cases where the impounded water is not compatible with the receiving ground water (i.e. contains constituents which would probably cause an exceedance of protection levels if released in small quantities), a composite liner consisting of a synthetic flexible membrane liner (FML) in intimate contact with a 12-inch clay liner is highly recommended, in addition to ground water monitoring. In order to insure intimate contact between the clay and FML, and to prevent flotation of the FML resulting from pinhole leaks, a "head break" system is usually needed. This may consist of two FMLs separated by a geonet or other permeable medium, with the lower liner in contact with the clay layer. The space between the two FMLs must drain to a sump which can be monitored for leakage. Compliance is demonstrated by monitoring inflow into the sump to insure that a maximum allowable leakage rate is not exceeded. This configuration would usually be appropriate only in conjunction with ground water monitoring, in order to insure that no fluids are released into the environment.

In very sensitive hydrogeologic settings or where the fluids stored in the pond are highly toxic, and ground water monitoring is not feasible, a leak detection system may be needed in addition to the "head break" described above, to provide appropriate containment and a means for compliance monitoring. This will usually require a third FML separated from the head break liners by a permeable medium and overlying a 12-inch clay layer. The layer above the lowest FML must drain to a sump which can be monitored. Compliance will be demonstrated by no presence of fluids in the leak detection sump.

Sewage Lagoons

All sewage lagoons must obtain a construction permit from DWQ. The lagoons must be built according to the standards in UAC R317-3-10.

Municipal sewage lagoons which receive sewage from only domestic sources (i.e. those with no “significant industrial dischargers”, as defined in F317-8-8.2(12), in their service districts) are permitted-by-rule under the Ground Water Quality Protection Rules, and a ground water discharge permit is not normally required. Lagoons which service significant industrial dischargers must apply for both construction and ground water discharge permits.

Sewage lagoons are typically constructed to allow some seepage through their liners. Lagoons should not be located in hydrogeologically sensitive areas where this small amount of seepage could cause an exceedance of ground water protection levels.

Sewage lagoons which are regulated under a ground water discharge permit and which have liners that allow a discharge should only be constructed in areas where ground water monitoring is feasible. At most sites, one upgradient and two to three downgradient monitor wells are usually needed. At a minimum, ground water must be monitored for nitrate, total dissolved solids and pH, as well as any site-specific parameters related to industrial discharges which may be of concern.

Sewage systems designed with a flow rate of less than 25,000 gallons per day are encouraged to use disposal methods other than lagoons. Proposals for smaller lagoons must be reviewed by the Executive Secretary if no other disposal method is feasible.

Animal Feeding Operations

Concentrated animal feeding operations (CAFOs) having over 1,500 animal units and a liquid waste handling system must obtain a construction permit and a ground water discharge permit from DWQ. An “animal unit” is a measurement based on the average weight of a particular type of animal and corresponds to one slaughter steer. CAFO limits for various animals include 1,500 slaughter cattle, 3,750 swine (over 55 pounds each), 1,050 dairy cattle, 15,000 sheep, or 82,500 turkeys. Smaller operations which do not meet these conditions need either a design approval from DWQ or a design certified by the USDA Natural Resources Conservation Service (NRCS).

The appropriate liner required for any animal feeding operation, regardless of size, shall be determined using liner criteria Tables 2a, 2b, and 2c in NRCS Conservation Practice Standard 313, Waste Storage Facility (August 2006). These tables determine the liner based on the risk and vulnerability of contamination to waters of the state, including ground water. For example, in areas of low vulnerability and moderate risk of ground water contamination, a 12-inch clay liner with a permeability no greater than 1×10^{-6} cm/sec is appropriate. On the other hand, in areas of high vulnerability and high risk of ground water contamination, a synthetic flexible membrane liner (FML) with a permeability no greater than 1×10^{-12} cm/sec is required. A construction permit must be approved and issued before construction may begin. Ground water quality should be monitored for total dissolved solids, nitrate plus nitrite as N, ammonia as N, chloride, pH and any other parameters which may be of concern at the site.

Most animal waste lagoons in Utah will probably be located in alluvial valley areas with relatively shallow ground water. In these settings ground water monitoring is required to demonstrate permit compliance with ground water protection levels. In other settings different requirements may apply. In general, with ground water depths around 100 feet or greater, uncertainty about correct well placement coupled with high drilling costs would tend to make monitor wells infeasible.

In recharge zones of Great Basin alluvial valleys, ground water may be too deep and the geologic structure too complex to develop a meaningful compliance ground water monitoring plan at a reasonable cost. If a lagoon must be built in such areas, a design employing a leak detection system may be more cost-effective than monitor wells. An example of such design would be two FMLs separated by a geogrid, with the geogrid space between the liners designed to drain to a sump which can be monitored for head, volume, and water quality.

In certain other areas with low vulnerability and slight risk of ground water degradation, it could be reasonably expected that the small amount of seepage from a properly-constructed animal waste lagoon would not harm beneficial uses of ground water. In these cases ground water monitoring requirements could be waived. Areas where natural ground water quality is saline or where low-permeability aquitard formations are exposed at the surface could qualify for this waiver. Examples of such settings in Utah could be the Mancos Shale outcrop or areas of fine-grained sediment and Class IV saline ground water in alluvial valleys.

Leach Pads

Many mining operations rely on heap leaching to extract precious metals from ore. In this process granular ore materials are

stacked in a pile and sprinkled with a solution which leaches metal ions from the ore material. After the metals are extracted from the solution, the solution is often re-used. This process is often used for extraction of gold from low-grade ore with cyanide solution, but other metals may also be recovered by heap leaching, such as beryllium or copper.

Applicants for heap leach extraction facilities should refer to the Design and Construction Guidance Document for Precious Metals Heap Leach Extraction Facilities (June 1998), which is posted on the DWQ Ground Water Home Page under Publications and Rules.

Almost all ore deposits in Utah that heap leach technology would be applicable are located in recharge zones of mountainous areas. The leach solutions are usually toxic, particularly the cyanide solutions used for gold extraction. Therefore, in most cases leach pads should be designed to allow **no discharge** of process fluids, and should incorporate a leak detection system for compliance monitoring. Most mine sites in mountainous areas will have deep ground water and complex geologic structure, which could make ground water monitoring difficult and expensive. In these cases, the leak detection system for the leach pad should be sealed from the underlying ground in such a way as to assure that fluids will not escape even if there is a leak in the primary liner and fluids collect in the leak detection system. Leach pad projects must obtain a construction permit from DWQ before construction may begin, in addition to a ground water discharge permit.

An example of an acceptable liner approach that could stand alone and not need ground water monitoring would include the following components, from top to bottom:

1. The stacked ore.
2. A granular cushion layer to protect underlying liners.
3. The process fluid collection system.
4. The primary liner – an 80-mil thick geomembrane (compatible with leachate chemistry) in intimate contact with a 12-inch clay layer of hydraulic conductivity 1×10^{-7} cm/sec or less.
5. A barrier geotextile to prevent mixing of the clay with the underlying leak detection medium.
6. A leak detection medium of hydraulic conductivity of 1×10^{-2} cm/sec or greater, either granular material (sand/gravel) or a synthetic geonet.
7. Leakage collection and conveyance piping.
8. A leak detection system seal. In areas of high to moderate ground water vulnerability with good quality ground water, the seal should consist of a 60-mil thick geomembrane overlying 12 inches of clay with hydraulic conductivity of 1×10^{-7} cm/sec or less. In areas with less vulnerability or poorer quality ground water, either the membrane or clay layer may be used alone.

Hydraulic head on the primary liner should be minimized to no more than one foot, so a “head break” design is not needed as in process water ponds. Valley fill or other designs requiring construction on slopes of 7 percent or greater are discouraged because of the low strength of liner materials. Different design criteria will apply if construction under these conditions is necessary. Leach pads intended for repeated uses will require additional structural reinforcement to insure liner integrity.

Alternative designs that achieve the same or better protection of ground water may be utilized with Division approval.

Tailings Impoundments

Many ore processing operations generate large volumes of tailings, often in slurry form with solid to water ratio as high as 55/45. Water in the slurry often contains many contaminants leached from the ore materials and introduced during the extraction process using chemical reagents. The large volumes of tailings wastes require a large area for their disposal. Often these impoundments are located in highly vulnerable mountain areas near the mine site, whose hydrogeologic properties make ground water monitoring difficult and expensive. In these cases, an impoundment design employing double FMLs with a leak detection system may be more cost-effective than monitor wells. An example of such design would be two FMLs separated by a geogrid, with the geogrid space between the liners designed to drain to a collection sump which can be monitored for head, volume, and water quality analysis.

Permittees should use any feasible methods to minimize impacts to ground water from tailings impoundments. Among the options that should be considered are detoxification treatment for the tailings, best practical liner design, and selection of the least vulnerable site possible. Liners which allow a monitoring plan that will detect ground water contamination in the fastest time feasible. In many cases, this may require ground water monitoring, despite the expenses and difficulties involved in designing and installing a meaningful monitor well network. Permit applications must contain an acceptable contingency plan to bring the facility into compliance if ground water protection levels are exceeded. The permit applicant must commit to an

acceptable closure plan which will prevent ground water contamination after the end of the facility's use.

Land Application

Land application of materials such as sewage sludge or agricultural manure should be done in a manner which will not cause contamination of ground water above the appropriate protection levels. In many instances this type of application may qualify for permit by rule because of *de minimis* (negligible) impact on ground water quality. Allowable application rates have been developed for some types of land applied materials in hydrogeologic settings with low to moderate ground water vulnerability and many with high vulnerability. Land application of sewage sludge and animal manure which are used as fertilizer are permitted by rule under the Ground Water Quality Protection Rules when applied at the "agronomic uptake rate", i.e. the rate at which all plant nutrients are expected to be taken up by crops or other vegetation and would not migrate below the root zone. To qualify for permit by rule for land application, the operation must have an NRCS-approved Comprehensive Nutrient Management Plan (CNMP) or a Plan of Operation approved by the Division of Solid and Hazardous Waste.

Some areas of high vulnerability, however, may be impacted by land-applied materials, allowing pollutants to move directly into important aquifers. Examples of such settings are areas of coarse-grained soils in recharge zones and areas of karst topography on limestone outcrops. The applicant assumes the risk of causing ground water pollution in these sites even if the activity is permitted by rule.

All proposals for land applications of materials which are not permitted by rule

should be reviewed by the Division of Water Quality. The applicant should supply information which would allow a determination of the activity's potential impacts to ground water. This information must include the location of the proposed land application, characteristics of the waste, and application rates. Information on soil characteristics must be included if the application is in an area of high ground water vulnerability and the applicant is proposing that pollutants will be bound to soil particles and not enter ground water. In some cases the land application would need to be regulated under a ground water discharge permit; some proposals may not be permissible because of the characteristics of the waste or the application site. Repeated applications at the same site in areas of high vulnerability require a ground water discharge permit to demonstrate that the disposal is not causing ground water contamination. Land application of oil field wastes is regulated by the Division of Oil, Gas and Mining in the Department of Natural Resources.

Landfills

Landfills which are not regulated by the Division of Solid and Hazardous Waste are subject to Ground Water Quality Protection Rules and may be required to obtain a ground water discharge permit. In most cases, wastes placed into landfills are in a solid form, and the primary threat to ground water is leachate generated by precipitation infiltrating through the waste. The constituents dissolved in this leachate, in combination with the site characteristics, determine the appropriate control technology and regulatory requirements. Slurries and wastes with high liquid content that are placed in landfills must be properly managed to prevent subsurface discharge of contaminants and exceedences of ground water protection levels.

Permit applicants should make an estimate of the characteristics of leachate which would be generated by the landfill. Some types of waste may not require any special treatment to control leachate, and the landfill may qualify for permit-by-rule. If leachate may cause an exceedance of ground water protection levels, control technology regulated under a ground water discharge permit will be necessary. In cases where the leachate quality and vulnerability of the site present a low to moderate threat to ground water, capping the landfill with low-permeability earth layers or flexible membrane liners to exclude precipitation may be adequate containment technology. Landfills which present a greater risk due to toxic components in leachate or highly vulnerable site characteristics may require bottom liners in addition to capping. All permitted landfills should have some means of compliance monitoring. At many sites, ground water monitoring wells may serve this purpose. Where ground water monitoring is not feasible, other means to prevent leachate discharge or monitor leachate quality may be necessary. Some examples of alternate control and monitoring technologies may be impermeable lower liners with a leachate collection and removal system, or collection lysimeters to monitor leachate quality and its movement into the vadose zone.

Waste Piles, Storage Piles and Mine Waste Rock

Accumulations of solid materials which may cause a discharge of contaminants to ground water when exposed to precipitation will be regulated in a manner similar to landfills. Regulatory requirements will be determined by the leachate characteristics and ground water vulnerability at the site. If waste or storage piles at a particular site are determined to present a threat to ground water, appropriate control technology and

compliance monitoring will be required under the framework of a ground water discharge permit. Control technology may consist of impermeable bottom liners, leachate collection systems, or temporary covers. In some cases, rapid turnover of waste or storage piles may be a reason for less strict permit requirements, because materials in the piles would be removed before accumulating enough precipitation to cause a discharge of leachate. Compliance monitoring may involve ground water monitoring, vadose zone monitoring, or containment performance monitoring.

Mine waste rock must be managed in such a way that it will not cause ground water contamination. A ground water discharge permit will be required for waste rock piles unless the mine operator can demonstrate that the waste rock will not produce leachate which will affect ground water quality. Evaluation of leachate producing potential should take into account the effects of weathering on the rock over time. Laboratory testing methods such as toxicity characteristic leaching procedure (TCLP) can estimate leachability for determining appropriate waste rock management. Waste rock testing should be used from the earliest stages of mine development to guide planning for future waste rock disposal. Waste rock management may be covered under the same permit as other mine facilities. Appropriate containment control technology may involve constructing an engineered cover system over the waste rock piles to prevent infiltration of precipitation through the wastes. Compliance monitoring required by the permit may be accomplished by ground water monitoring wells or a vadose zone monitoring system such as lysimeters.

Appendix A

PERMIT APPLICATION FORM

The following permit application form is designed to assist potential applicants in submitting a Ground Water Discharge Permit Application. This format is not mandatory but only guidance. Applicants are free to use the format they deem appropriate as long as the requirements of R317-6-6.3 of the Ground Water Quality Protection Rules are met.

MAIL TO:

Utah Division of Water Quality
P.O Box 144870
Salt Lake City, Utah 84114-4870

Application No.: _____
Date Received: _____
(leave both lines blank)

UTAH GROUND WATER DISCHARGE PERMIT APPLICATION

Part A - General Facility Information

Please read and follow carefully the instructions on this application form. Please type or print, except for signatures. This application is to be submitted by the owner or operator of a facility having one or more discharges to groundwater. The application must be signed by an official facility representative who is: the owner, sole proprietor for a sole proprietorship, a general partner, an executive officer of at least the level of vice president for a corporation, or an authorized representative of such executive officer having overall responsibility for the operation of the facility.

- 1. Administrative Information.** Enter the information requested in the space provided below, including the name, title and telephone number of an agent at the facility who can answer questions regarding this application.

Facility Name: _____

Mail Address: _____
(Number & Street, Box and/or Route, City, State, Zip Code)

Facility Legal Location* _____ County: _____
T. _____, R. _____, Sec. _____, _____ 1/4 of _____ 1/4,
Lat. _____ ° _____ ' _____ "N. Long. _____ ° _____ ' _____ "W

*Note: A topographic map or detailed aerial photograph should be used in conjunction with a written description to depict the location of the facility, points of ground water discharge, and other relevant features/objects.

Contact's Name: _____ Phone No.:(_____) _____
Title: _____

- 2. Owner/Operator Information.** Enter the information requested below, including the name, title, and phone number of the official representative signing the application.

Owner
Name: _____ Phone No.:(_____) _____

Mail Address: _____
(Number & Street, Box and/or Route, City, State, Zip Code)

Operator
Name: _____ Phone No.:(_____) _____
(If different than Owner's above)

Mail Address: _____
(Number & Street, Box and/or Route, City, State, Zip Code)

Official Representative
Name: _____ Phone No.:(_____) _____
Title: _____

3. Facility Classification (check one)

- New Facility
- Existing Facility
- Modification of Existing Facility

4. Type of Facility (check one)

- Industrial
- Mining
- Municipal
- Agricultural Operation
- Other, please describe: _____

5. SIC/NAICS Codes: _____
Enter Principal 3 Digit Code Numbers Used in Census & Other Government Reports

6. Projected Facility Life: _____ years

7. Identify principal processes used, or services performed by the facility. Include the principal products produced, and raw materials used by the facility:

8. List all existing or pending Federal, State, and Local government environmental permits:

	<u>Permit Number</u>
<input type="checkbox"/> NPDES or UPDES (discharges to surface water)	_____
<input type="checkbox"/> CAFO (concentrated animal feeding operation)	_____
<input type="checkbox"/> UIC (underground injection of fluids)	_____
<input type="checkbox"/> RCRA (hazardous waste)	_____
<input type="checkbox"/> PDS (air emissions from proposed sources)	_____
<input type="checkbox"/> Construction Permit (wastewater treatment)	_____
<input type="checkbox"/> Solid Waste Permit (sanitary landfills, incinerators)	_____
<input type="checkbox"/> Septic Tank/Drainfield	_____
<input type="checkbox"/> Other, specify _____	_____

9. Name, location (Lat. _____ ° _____ ' _____ "N, Long. _____ ° _____ ' _____ "W) and description of: each well/spring (existing, abandoned, or proposed), water usage(past, present, or future); water bodies; drainages; well-head protection areas; drinking water source protection zones according to UAC 309-600; topography; and man-made structures within one mile radius of the point(s) of discharge site. Provide existing well logs (include total depth and variations in water depths).

<u>Name</u>	<u>Location</u>	<u>Description</u>	<u>Status</u>	<u>Usage</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

The above information must be included on a plat map and attached to the application.

Part B - General Discharge Information

Complete the following information for each point of discharge to ground water. If more than one discharge point exists, photocopy and complete this Part B form for each discharge point.

1. Location (if different than Facility Location in Part A):

County: _____
T. _____, R. _____, Sec. _____, _____ 1/4 of _____ 1/4,
Lat. _____ ° _____ ' _____ "N. Long. _____ ° _____ ' _____ "W

2. Type of fluid to be Discharged or Potentially Discharged

(check as applicable)

Discharges (fluids discharged to the ground)

- Sanitary Wastewater: wastewater from restrooms, toilets, showers and the like
- Cooling Water: non-contact cooling water, non contact of raw materials, intermediate, final, or waste products
- Process Wastewater: wastewater used in or generated by an industrial process
- Mine Water: water from dewatering operations at mines
- Other, specify: _____

Potential Discharges (leachates or other fluids that may discharge to the ground)

- Solid Waste Leachates: leachates from solid waste impoundments or landfills
- Milling/Mining Leachates: tailings impoundments, mine leaching operations, etc.
- Storage Pile Leachates: leachates from storage piles of raw materials, product, or wastes
- Potential Underground Tank Leakage: tanks not regulated by UST or RCRA only
- Other, specify: _____

3. Discharge Volumes

For each type of discharge checked in #2 above, list the volumes of wastewater discharged to the ground or ground water. Volumes of wastewater should be measured or calculated from water usage. If it is necessary to estimate volumes, enclose the number in parentheses. Average daily volume means the average per operating day: ex. For a discharge of 1,000,000 gallons per year from a facility operating 200 days, the average daily volume is 5,000 gallons.

Discharge Type:	Daily Discharge Volume		all in units of
	(Average)	(Maximum)	
_____	_____	_____	_____
_____	_____	_____	_____

4. Potential Discharge Volumes

For each type of potential discharge checked in #2 above, list the maximum volume of fluid that could be discharged to the ground considering such factors as: liner hydraulic conductivity and operating head conditions, leak detection system sensitivity, leachate collection system efficiency, etc. Attach calculation and raw data used to determine said potential discharge.

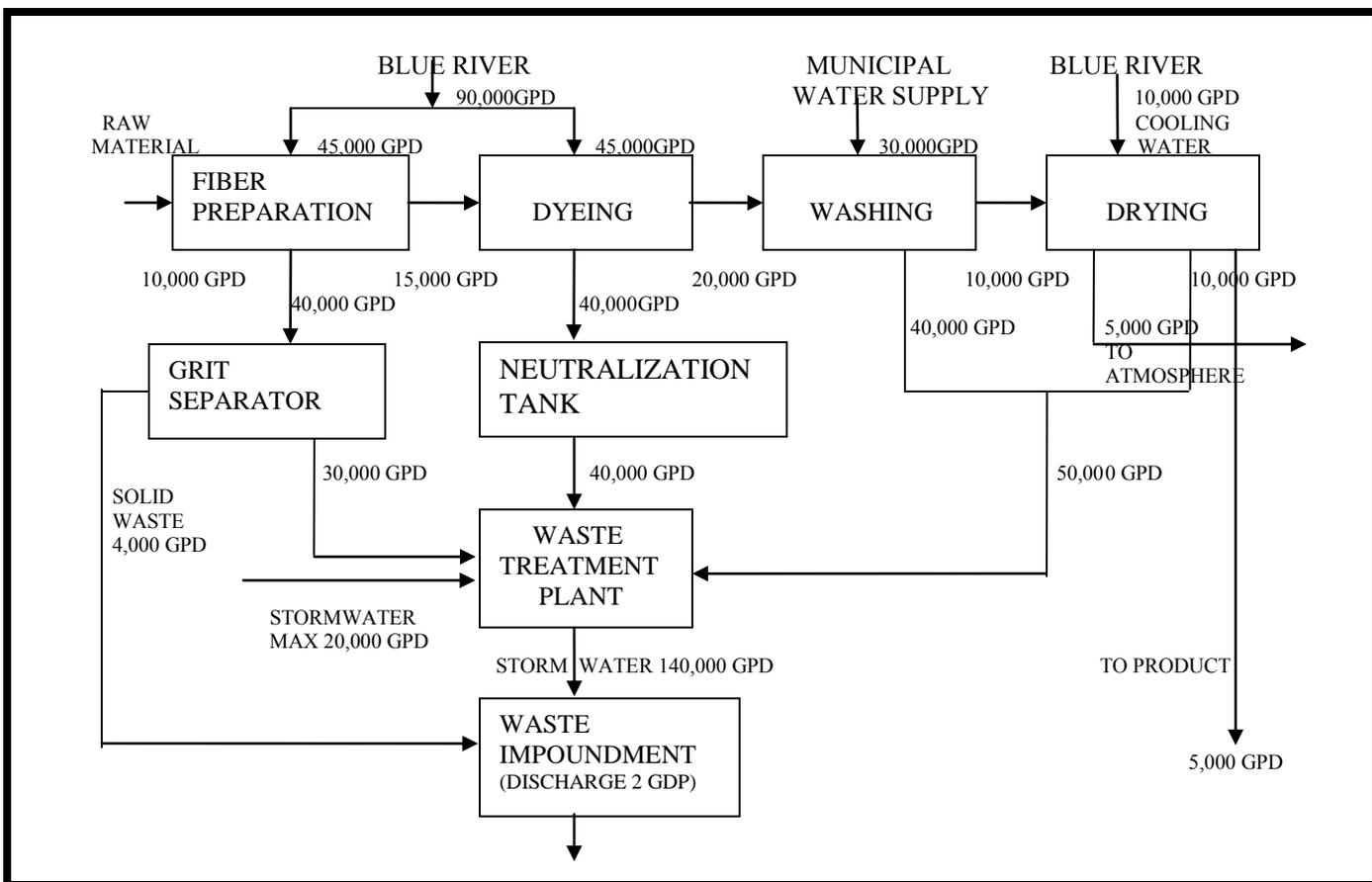
Discharge Type:	Daily Discharge Volume		all in units of
	(Average)	(Maximum)	
_____	_____	_____	_____
_____	_____	_____	_____

5. Means of Discharge or Potential Discharge (check one or more as applicable)

- | | |
|---|---|
| <input type="checkbox"/> lagoon, pit, or surface impoundment (fluids) | <input type="checkbox"/> industrial drainfield |
| <input type="checkbox"/> land application or land treatment | <input type="checkbox"/> underground storage tank |
| <input type="checkbox"/> discharge to an ephemeral drainage
(dry wash, etc.) | <input type="checkbox"/> percolation/infiltration basin |
| <input type="checkbox"/> storage pile | <input type="checkbox"/> mine heap or dump leach |
| <input type="checkbox"/> landfill (industrial or solid wastes) | <input type="checkbox"/> mine tailings pond |
| <input type="checkbox"/> other, specify _____ | |

6. Flows, Sources of Pollution, and Treatment Technologies

Flows. Attach a line drawing showing: 1) water flow through the facility to the ground water discharge point, and 2) sources of fluids, wastes, or solids which accumulate at the potential ground water discharge point. Indicate sources of intake materials or water, operations contributing wastes or wastewater to the effluent, and wastewater treatment units. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and wastewater outfalls. If a water balance cannot be determined, provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures. See the following example.



7. Discharge Effluent Characteristics

Established and Proposed Ground Water Quality Standards - Identify wastewater or leachate characteristics by providing the type, source, chemical, physical, radiological, and toxic characteristics of wastewater or leachate to be discharged or potentially discharged to ground water (with lab analytical data if possible). This should include the discharge rate or combination of discharges, and the expected concentrations of any pollutant (mg/l). If more than one discharge point is used, information for each point must be provided.

Hazardous Substances - Review the present hazardous substances found in the Clean Water Act, if applicable. List those substances found or believed present in the discharge or potential discharge.

Part C - Accompanying Reports and Plans

The following reports and plans should be prepared by or under the direction of a professional engineer or other ground water professional. Since ground water permits cover a large variety of discharge activities, the appropriate details and requirements of the following reports and plans will be covered in the pre-design meeting(s). For further instruction refer to the Ground Water Permit Application Guidance Document.

8. Hydrogeologic Report

Provide a Geologic Description, with references used, that includes as appropriate:

Structural Geology – regional and local, particularly faults, fractures, joints and bedding plane joints;

Stratigraphy – geologic formations and thickness, soil types and thickness, depth to bedrock;

Topography – provide a USGS MAP (7 ½ minute series) which clearly identifies legal site location boundaries, indicated 100 year flood plain area and applicable flood control or drainage barriers and surrounding land uses.

Provide a Hydrologic Description, with references used, that includes:

Ground water – depths, flow directions and gradients. Well logs should be included if available.

Include name of aquifer, saturated thickness, flow directions, porosity, hydraulic conductivity, and other flow characteristics, hydraulic connection with other aquifers or surface sources, recharge information, water in storage, usage, and the projected aerial extent of the aquifer. Should include projected ground water area of influence affected by the discharge. Provide hydraulic gradient map indicating equal potential head contours and ground water flow lines. Obtain water elevations of nearby wells at the time of the hydrologic investigation. Collect and analyze ground water samples from the uppermost aquifer which underlies the discharge point(s). Historic data can be used if the applicant can demonstrate it meets the requirements contained within this section. Collection points should be hydraulically up and downgradient and within a one-mile radius of the discharge point(s). Ground water analysis should include each element listed in Ground Water Discharge Permit Application, Part B7.

NOTE Failure to analyze for background concentrations of any contaminant of concern in the discharge or potential discharge may result in the Executive Secretary's presumptive determination that zero concentration exist in the background ground water quality.

Sample Collection and Analysis Quality assurance – sample collection and Preservation must meet the requirements of the EPA RCRA Technical Enforcement Guidance Document, OSWER-9959.1, 1986 [UAC R317-6-6.3(I,6)]. Sample analysis must be performed by State of Utah certified laboratories and be certified for each of the parameters of concern. Analytical methods should be selected from the following sources [UAC R317-6-6.3L]: (Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998; EPA, Methods for Chemical Analysis of Water and Wastes, 1983; Techniques of Water Resources Investigation of the U.S. Geological Survey, 1998, Book 9; EPA Methods published pursuant to 40 CFR Parts 141, 142, 264 (including Appendix IX), and 270. Analytical methods selected should also include minimum detection limits below both the Ground Water Quality Standards and the anticipated ground water protection levels. Data shall be presented in accordance of accepted hydrogeologic standards and practice.

Provide Agricultural Description, with references used, that includes:

If agricultural crops are grown within legal boundaries of the site the discussion must include: types of crops produced; soil types present; irrigation system; location of livestock confinement areas (existing or abandoned).

Note on Protection Levels:

After the applicant has defined the quality of the fluid to be discharged (Ground Water Discharge Permit Application, Part B), characterized by the local hydrogeologic conditions and determined background ground water quality (Hydrogeologic Report), the Executive Secretary will determine the applicable ground water class, based on: 1) the location of the discharge point within an area of formally classified ground water, or the background value of total dissolved solids. Accordingly, the Executive Secretary will determine applicable protection levels for each pollutant of concern, based on background concentrations and in accordance with UAC R317-6-4.

9. Ground Water Discharge Control Plan:

Select a compliance monitoring method and demonstrate an adequate discharge control system. Listed are some of the Discharge Control Options available.

No Discharge – prevent any discharge of fluids to the ground water by lining the discharge point with multiple synthetic and clay liners. Such a system would be designed, constructed, and operated to prevent any release of fluids during both the active life and any post-closure period required.

Earthen Liner – control the volume and rate of effluent seepage by lining the discharge point with a low permeability earthen liner (e.g. clay). Then demonstrate that the receiving ground water, at a point as close as practical to the discharge point, does not or will not exceed the applicable class TDS limits and protection levels* set by the Executive Secretary. This demonstration should also be based on numerical or analytical saturated or unsaturated ground water flow and contaminant transport simulations.

Effluent Pretreatment – demonstrate that the quality of the raw or treated effluent at the point of discharge or potential discharge does not or will not exceed the applicable ground water class TDS limits and protection levels* set by the Executive Secretary.

Contaminant Transport/Attenuation – demonstrate that due to subsurface contaminant transport mechanisms at the site, raw or treated effluent does not or will not cause the receiving ground water, at a point as close as possible to the discharge point, to exceed the applicable class TDS limits and protection levels* set by the Executive Secretary.

Other Methods – demonstrate by some other method, acceptable to the Executive Secretary, that the ground water class TDS limits and protection levels* will be met by the receiving ground water at a point as close as practical to the discharge point.

*If the applicant has or will apply for an alternate concentration limit (ACL), the ACL may apply instead of the class TDS limits and protection levels.

Submit a complete set of engineering plans and specifications relating to the construction, modification, and operation of the discharge point or system. Construction Permits for the following types of facilities will satisfy these requirements. They include: municipal waste lagoons; municipal sludge storage and on-site sludge disposal; land application of wastewater effluent; heap leach facilities; other process wastewater treatment equipment or systems.

Facilities such as storage piles, surface impoundments and landfills must submit engineering plans and specifications for the initial construction or any modification of the facility. This will include the design

data and description of the leachate detection, collection and removal system design and construction. Provide provisions for run on and run-off control.

10. **Compliance Monitoring Plan:**

The applicant should demonstrate that the method of compliance monitoring selected meets the following requirements:

Ground Water Monitoring – that the monitoring wells, springs, drains, etc., meet all of the following criteria: is completed exclusively in the same uppermost aquifer that underlies the discharge point(s) and is intercepted by the upgradient background monitoring well; is located hydraulically downgradient of the discharge point(s); designed, constructed, and operated for optimal detection (this will require a hydrogeologic characterization of the area circumscribed by the background sampling point, discharge point and compliance monitoring points); is not located within the radius of influence of any beneficial use public or private water supply; sampling parameters, collection, preservation, and analysis should be the same as background sampling point; ground water flow direction and gradient, background quality at the site, and the quality of the ground water at the compliance monitoring point.

Source Monitoring – must provide early warning of a potential violation of ground water protection levels, and/or class TDS limits and be as or more reliable, effective, and determinate than a viable ground water monitoring network.

Vadose Zone Monitoring Requirements – Should be: used in conjunction with source monitoring; include sampling for all the parameters required for background ground water quality monitoring; the application, design, construction, operation, and maintenance of the monitoring system should conform with the guidelines found in: Vadose Zone Monitoring for Hazardous Waste Sites; June 1983, KT-82-018(R).

Leak Detection Monitoring Requirements – Should not allow any leakage to escape undetected that may cause the receiving ground water to exceed applicable ground water protection levels during the active life and any required post-closure care period of the discharge point. This demonstration may be accomplished through the use of numeric or analytic, saturated or unsaturated, ground water flow or contaminant transport simulations, using actual filed data or conservative assumptions. Provide plans for daily observation or continuous monitoring of the observation sump or other monitoring point and for the reporting of any fluid detected and chemical analysis thereof.

Specific Requirements for Other Methods – Demonstrate that: the method is as or more reliable, effective, and determinate than a viable ground water monitoring well network at detecting any violation of ground water protection levels or class TDS limits, that may be caused by the discharge or potential discharge; the method will provide early warning of a potential violation of ground water protection levels or class TDS limits and meets or exceeds the requirements for vadose zone or leak detection monitoring.

Monitoring well construction and ground water sampling should conform to A Guide to the Selection of Materials for Monitoring Well Construction. Sample collection and preservation, should conform to the EPA RCRA Technical Enforcement Guidance Document, OSWER-9950.1, September, 1986. Sample analysis must be performed by State-certified laboratories by methods outlined in UAC R317-6-6.3L. Analytical methods used should have minimum detection levels which meet or are less than both the ground water quality standards and the anticipated protection levels.

11. **Closure and Post Closure Plan:** The purpose of this plan is to prevent ground water contamination after cessation of the discharge or potential discharge and to monitor the discharge or potential discharge

point after closure, as necessary. This plan has to include discussion on: liquids or products, soils and sludges; remediation process; the monitoring of the discharge or potential discharge point(s) after closure of the activity.

- 12. Contingency and Corrective Action Plans:** The purpose of this Contingency plan is to outline definitive actions to bring a discharge or potential discharge facility into compliance with the regulations or the permit, should a violation occur. This applies to both new and existing facilities. For existing facilities that may have caused any violations of the Ground Water Quality Standards or class TDS limits as a result of discharges prior to the issuance of the permit, a plan to correct or remedy any contaminated ground water must be included.

Contingency Plan – This plan should address: cessation of discharge until the cause of the violation can be repaired or corrected; facility remediation to correct the discharge or violation.

Corrective Action Plan – for existing facilities that have already violated Ground Water Quality Standards, this plan should include: a characterization of contaminated ground water; facility remediation proposed or ongoing including timetable for work completion; ground water remediation.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME & OFFICIAL TITLE (type or print)

PHONE NO. (area code & no.)

SIGNATURE

DATE SIGNED